

REMARKS

This application contained claims 1-53. Claims 18 and 52 have been amended. Claim 53 has been canceled and new claim 54 which depends from claim 1 has been added. On entrance of this amendment, claims 1-52 and 54 are in this case.

Telephone Interview with the Examiner

The undersigned thanks Examiner Hertzog for the courtesy of a telephone interview on December 1, 2005 to discuss the prior art rejections herein. Inventor Srinivas took part in the interview. This response is a follow-up to that interview and provides the Declaration of inventor Girish Srinivas under 37 C.F.R. 1.131 providing information discussed in the interview. The Examiner had indicated that she would consider this declaration.

Amendments to the Claims

Claim 18 has been amended to improve clarity by correcting Markush language as suggested by the Examiner.

Claim 52 has been amended to incorporate the subject matter of claim 53 which has been canceled in order to allow entrance of one new dependent claim 54.

Claim 54 has been added to claim the use of the method on gas streams having a certain range of mercury levels, which is supported in the specification at page 20, line 21.

The amendments to the claims do not add new matter to the specification and no new issues are raised. New claim 54 depends from claim 1 and if claim 1 is found allowable, claim 54 will also be allowable. Applicants respectfully request entrance of the amendment after final. The amendment raises no new issues of patentability. The amendment of claim 18 obviates an objection to that claim.

The Objection to claim 18

Claim 18 has been objected to as having improper Markush language. Claim 18 has been amended as suggested by the Examiner obviating this objection.

The Rejections

Claims 1-3 and 5-52 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Srinivas et al. U.S. patent 6,099,819 in view of Audeh U.S. patent 4,786,483. Applicant respectfully traverses this rejection with respect to all of the claims.

The previous Office Action alleged that the '819 patent teaches methods for treating hydrogen sulfide-containing gas streams which meet all of the material limitations of the rejected claims with the exception that the '819 patent does not teach the simultaneous removal of mercury and hydrogen sulfide. The previous Office Action further alleged that it would have been obvious to employ the methods and catalysts of the '819 patent to treat natural gas streams. The current Office Action states:

It is appreciated that the presence of mercury is not disclosed in the '819 patent; indeed, if it were, then the '819 patent would have been applied on its own against the instant claims. However, it is respectfully maintained that, in light of the '483 patent (Audeh) disclosure that some natural gas fields yield natural gas containing **both H₂S and mercury** (see col. 1, lines 10-12)—and that removal of both in a single step is desirable (see col. 1, lines 41-44)—one of ordinary skill in the art would have been motivated to treat such a gas when having utilized the '819 processes to treat natural gas, thereby simultaneously removing sulfur and mercury. Thus, it is submitted that the artisan would in fact not have employed other methods to remove mercury, instead having recognized that the '819 catalysts function to remove same; it is respectfully maintained that there is no evidence of record indicating otherwise. And “arguments of counsel cannot take the place of evidence in the record. (citations omitted). Applicant's point that the '483 patent “teaches that some (notably not all) natural gas streams contain H₂S and mercury” (citation omitted) has been noted, but the '819 patent --- the **primary** reference in the rejections of record—is already considered to teach the treatment of **any** natural gas stream. (emphasis in the original)

The current Office Action emphasizes that the Audeh reference is cited only for its “Prior Art” section as evidence that some natural gas streams contain both H₂S and mercury and as evidence that simultaneous removal of these species was desirable. The current Office Action further states that the tertiary reference is relied upon as

showing that the catalytic treatment of gas streams containing not only H₂S but also hydrogen and carbon dioxide was known in the art.

Applicants first wish to reemphasize that not all natural gas streams contain both H₂S and mercury and more generally that not all gas streams from which one would wish to remove H₂S by application of the catalysts of the '819 patent contain mercury. Thus, simultaneous removal of H₂S and mercury is not an inevitable consequence of the practice of the method of the '819 patent. Simultaneous removal of hydrogen sulfide and mercury is thus not inherent in the practice of the process of the '819 patent.

The '819 patent does not teach simultaneous removal of hydrogen sulfide and mercury from gas streams. The '819 patent does not teach or suggest that any of the catalysts disclosed therein function in the presence of mercury and more importantly there is no teaching or suggestion that mercuric sulfide would be formed under the conditions of the methods disclosed and could be removed and condensed with sulfur formed by oxidation of hydrogen sulfide. It appears that the Office does not contest these facts. Further, no references or other evidence have been presented on the record in support of this rejection to show that it was known in the art prior to the present invention that the process and catalysts of the '819 invention when applied to gas streams containing both hydrogen sulfide and mercury would function to remove both of these undesirable contaminants in a single step.

In the absence of such knowledge in the art, i.e., prior to the present invention, one of ordinary skill in the art faced with the problem of removal of both H₂S and mercury from a gas stream would have employed a method known in the art for mercury removal, e.g., employing two separate steps to remove the different contaminants. Without the knowledge provided by the present invention, one of ordinary skill in the art would not have known that if the process of the '819 patent were reemployed that a separate step of mercury removal would not be needed. Further, assuming that a single step process would be preferred, the skilled artisan faced with the problem of removing both hydrogen sulfide and mercury, again in the absence of the knowledge provided by this invention, would have more likely been motivated to apply the art-known method of the Audeh '483 patent to remove both contaminants with a single sorbent. In view of the Audeh patent, the method of which is reported to

remove both contaminants, the skilled artisan would not have been motivated to employ the method of the '819 patent (which is reported only to remove hydrogen sulfide) to remove both mercury and hydrogen sulfide from a gas stream.

The current Office Action emphasizes that the Audeh patent is cited only to show that some gas streams were known to be contaminated with mercury. However, Applicants submit that the Audeh patent forms a part of the prior art as a whole and is additionally relevant in the consideration of how one of ordinary skill in the art at the time this invention was made would have solved the problem of removing both mercury and hydrogen sulfide from a gas stream. The ordinary skilled artisan, on reviewing the entire teachings of the '819 and '493 patents, would not have been motivated to employ the catalysts of the '819 patent to simultaneously remove hydrogen sulfide and mercury. Rather in view of the teachings of the '493 patent, one of ordinary skill in the art would have employed the more desirable one-step process as taught by the '493 patent.

The reasoning given in the current Office Action to support the obviousness rejection appears to be that one of ordinary skill in the art would have been motivated to apply the method and catalysts of the '819 patent to a gas stream containing both hydrogen sulfide and mercury and as a result would find out (or discover) that simultaneous removal of both hydrogen sulfide and mercury had occurred and because of acquiring this new information would have then known that a separate step of mercury removal was not necessary. This reasoning is flawed and does not support a prima facie case of obviousness. This reasoning requires that one of ordinary skill in the art perform experiments and discover the additional benefit and function of the process that was until that time unknown in the art. In the absence of prior knowledge of this benefit and function, it would not have been obvious to one of ordinary skill in the art that simultaneous removal of hydrogen sulfide and mercury could be achieved using the '819 patent process and that artisan would not have known before making the discovery that an additional process step for removal of mercury would not have been required.

Applicants also emphasize that one of ordinary skill in the art at the time this invention was made would not have been motivated to apply the catalytic hydrogen sulfide removal process of the '819 patent to gas streams containing both hydrogen

sulfide and mercury because that artisan would be aware that mercury would likely detrimentally affect catalyst function and/or would likely detrimentally affect process equipment. Further, the inventors' findings that no significant catalyst deactivation occurred, that mercuric sulfide co-condensed with sulfur and that the process provided for very efficient mercury removal represent significant unexpected results that support non-obviousness of the method as claimed. The declaration of Girish Srinivas, an inventor hereof, under 37 C.F.R. 1.131 is submitted herewith to provide evidence supporting these arguments.

First, Dr. Srinivas confirms that mercury is a known contaminant of certain natural gas streams but that mercury is not present in all such gas streams.

Dr. Srinivas further states that in his experience that a researcher or engineer in this field would not apply a process such as the process of '819 patent to a gas stream without first considering the possible affect of other contaminants in the gas stream, such as mercury, on the process. Dr. Srinivas confirms that the '819 patent does not consider the affect of the presence of mercury in a gas stream on the process or the catalysts employed.

Dr. Srinivas explains that after the invention of the '819 patent was made, when he and his present co-inventor were faced with the problem of removal of both hydrogen sulfide and mercury from a gas stream that they were concerned first that under the conditions of the '819 process, mercury could react with sulfur being generated by the catalysts to form mercuric sulfide which would condense and rapidly deactivate and foul the catalyst leading to failure of the process for this application. As evidence that this concern was valid, Dr. Srinivas notes that condensation of sulfur itself onto the catalyst had been a significant concern during the development of the '819 process.

Because of the complexity of the chemical system that would result from application of the '819 catalysts to a gas stream containing both mercury and sulfur, Dr. Srinivas states that the co-inventors could not be sure without modeling the system whether mercuric sulfide would form under operating conditions with the '819 catalysts and where it would condense in the system (on the catalysts, in the equipment or if it would condense with the sulfur itself). Dr. Srinivas states that the modeling studies performed indicated that the mercuric sulfide would co-condense with the sulfur, rather

than in the catalyst bed. Dr. Srinivas also states that it was further not clear how efficient mercury removal would be on application of such a process. Finally, Dr. Srinivas states that co-condensation of mercuric sulfide with sulfur was confirmed by experiments and they also demonstrated very efficient mercury removal of greater than 95% in such gas streams.

The declaration provides facts which demonstrate that one having at least ordinary skill in the art would not have been motivated to apply the catalysts of the '819 patent, based only on the teachings of that patent, to a gas stream containing both hydrogen sulfide and mercury because of the significant practical concern that mercury or more likely mercuric sulfide would foul the catalyst and or the reactor equipment. Dr. Srinivas' declaration also provides evidence that the discovery that mercuric sulfide was formed and co-condensed with sulfur in the process without any significant detrimental fouling or deactivation of the catalyst was unexpected in view of what was known in the art. A further unexpected result of the invention was the discovery that the process as applied for simultaneous removal of hydrogen sulfide and mercury was very efficient.

Thus, in view of all of the forgoing, in the absence of any teaching or suggestion on the record that the catalysts and methods of the '819 patent could be employed for simultaneous removal of H₂S and mercury, and in the absence of motivation to apply the '819 process to gas streams containing both hydrogen sulfide and mercury no prima facie case of obviousness has been made and this rejection should be withdrawn. Additionally, the process as claimed applied to gas streams containing both hydrogen sulfide and mercury exhibits significant unexpected benefits avoiding expected catalyst deactivation and equipment fouling and provided very efficient mercury removal.

Claims 4 and 53 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Srinivas et al. U.S. patent 6,099,819 in view of Audeh U.S. patent 4,786,483 and further in view of Hass et al. U.S. patent 4,088,743. Applicant respectfully traverses this rejection.

Claims 4 and 53 relate to the treatment of gas streams containing hydrogen, carbon monoxide or mixtures thereof or synthesis gas (a mixture of hydrogen and carbon monoxide). Claim 53 has been cancelled and its subject matter introduced into amended claim 52. Applicants reiterate previously presented arguments with respect to

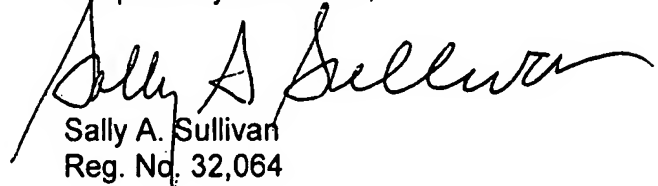
claims 4 and the subject matter of claim 53 and emphasize that Hass et al. does not cure the deficiencies of the teachings of the '819 patent with respect to simultaneous removal of hydrogen sulfide and mercury. For all of the reasons discussed above, claims 4 and 52 should be considered patentable.

Claim 54 has been added and is dependent upon claim 1. Again for all of the reasons argued above, claim 54 should be considered patentable over the cited references.

Conclusion

The claims as amended are believed to be in condition for allowance and passage to issuance is respectfully requested. No fees for excess claims are believed due. This submission is accompanied by a Petition for Extension of Time of One Month with appropriate fee. A check in the amount of \$60.00 is submitted herewith. If the enclosed amount is incorrect, please charge any deficiency or credit any overpayment to deposit account 07-1969.

Respectfully submitted,



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